

REMARKS**INTRODUCTION:**

In accordance with the foregoing, claim 2 has been amended. No new matter is being presented, and approval and entry are respectfully requested.

Claims 1-17 and 29-39 are pending and claims 1-17, 38, and 39 are under consideration. Reconsideration is requested.

On page 2 of the Office Action, the Examiner requires cancellation of withdrawn claims 29-37 or other appropriate action. However, it is respectfully submitted that withdrawn claims 29-37 have been amended to depend from elected linking claim 1. As noted in MPEP 809.04, "[w]here the requirement for restriction in an application is predicated upon the nonallowability of generic or other type of linking claims, applicant is entitled to retain in the case claims to the nonelected invention or inventions." As such, it is respectfully requested that the withdrawn claims 29-37 be allowed to remain in the instant application as per MPEP 809 since the applicants have taken the other appropriate action required in the Office Action.

Moreover, to the extent that the Examiner considers the elected claims 1-17, 38 and 39 unpatentable, it is respectfully submitted that the non-elected claims 29-37 should be rejoined since the Examiner's position of the unpatentability of the elected claims of Group I no longer supports the reasons for restriction between Groups I and III under the theory of distinct combinations and subcombinations. See MPEP 805.06(c).

REJECTION UNDER 35 U.S.C. §132:

In the Office Action at pages 2-3, the Examiner objects to the amendment to claim 2 under 35 U.S.C. §132 for introducing new matter into the specification. The objection is traversed and reconsideration is respectfully requested.

While it is respectfully submitted that the claim 2 as previously amended did not include new matter, claim 2 has been amended to more closely comport with the language used in the application as filed. As such, it is respectfully requested that the Examiner reconsider and withdraw the rejection under 35 U.S.C. §132.

REJECTION UNDER 35 U.S.C. §112:

On page 4 of the Office Action, the Examiner rejects claim 2 under 35 U.S.C. §112, first paragraph, as not being supported by the written description. This rejection is respectfully

traversed and reconsideration is requested.

While it is respectfully submitted that the amended claim 2 was compliant with 35 U.S.C. §112, first paragraph, claim 2 has been amended to more closely comport with the language used in the application as filed. As such, it is respectfully requested that the Examiner reconsider and withdraw the rejection under 35 U.S.C. §112.

REJECTION UNDER 35 U.S.C. §103:

A. Rejection of claims 1-4, 8-17, 38, and 39 in view of Chu and Japanese patent publication no. 47-28431

In the Office Action at pages 6-19, the Examiner rejects claims 1-4, 8-17, 38, and 39 under 35 U.S.C. §103 in view of Chu (U.S. Patent No. 5,523,179) and Japanese patent publication no. 47-28431 (hereinafter referred to as "JP '431"). The rejection is respectfully traversed and reconsideration is requested.

Among other features, the Examiner asserts that Chu teaches a lithium-sulfur battery using an active sulfur in a positive electrode and a lithium metal in the anode. However, the Examiner acknowledges on page 9 of the Office Action that Chu does not teach the positive electrode having pores as recited in claims 1-3. In order to cure this deficiency, the Examiner relies upon JP '431 as disclosing a cathode including sulfur and having pores in a range of 10-1000 µm. As a motivation to combine the references, the Examiner relies upon the Abstract of JP '431 as teaching that, since sulfur is an electric insulator, a porous separator with pore diameters of 10-1000 µm is essential to increase the conductivity.

On page 13 of the Office Action, the Examiner clarifies that this evidence of motivation is sufficient to support a prima facie obviousness rejection since the combined teachings of Chu and JP '431 suggest the combination and that a prima facie obviousness rejection can be maintained even where the teachings are not combinable so long as there is a suggestion to make the combination. On page 14 of the Office Action, the Examiner asserts that this burden is met since the combined prior art "directly" teaches all the claimed features.

By way of review, in order to establish a prima facie obviousness rejection, the Examiner needs to provide evidence of a motivation to combine the individual elements in order to create the recited invention. In establishing the motivation in light of the record as a whole, the Examiner needs to account for evidence of contrary, conflicting, and alternate teachings in order to set forth the extent to which one of ordinary skill in the art would have been persuaded to follow or not follow the proposed combination. In re Young, 18 USPQ2d 1089 (Fed. Cir. 1991) cited by MPEP 2143.01. As such, even assuming arguendo that the Examiner has set forth the proper legal standard, there remains a requirement that the Examiner provide evidence of a

motivation existing in the prior art to make the combination in a manner which meets the claimed combination.

In view of the above, other than asserting that both Chu and JP '431 teach all of the features including the claimed ranges, the Examiner has not proffered evidence of such a motivation. Specifically, the Examiner has not set forth evidence that one skilled in the art would have been motivated to alter the teaching of Chu to include porosity as a mechanism to improve conductivity. Chu already suggests a mechanism for improving conductivity, and instead suggests incorporating the elemental sulfur into a composite active material and using additives to further increase conductivity. (Col. 5, lines 1-37, col. 9, lines 46-60, and col. 10, lines 12-36 of Chu). Chu appears to teach away from using a graphite cloth, such as that suggested in JP '431, since Chu teaches that the composite electrode "is preferably prepared such that homogeneity of the product is obtained." As further explanation, Chu teaches that "[s]egregation of the components is preferably avoided," and "[a]lso avoided is agglomeration of any component particles or grains." (Col. 10, lines 28-37 of Chu). Thus, Chu teaches a solution to the conductivity problem relied upon by the Examiner to be the advantage in JP '431, and further teaches away from solutions like that in JP '431 which do not include mixing conductive materials into the electrode or which otherwise do not provide a homogeneous product.

There is no suggestion in Chu or in JP '431 that the graphite cloth of JP '431 presents a conductive solution that is homogenous or otherwise also meets the suggestion to have a homogenous product as set forth in Chu. There is further no evidence that the relevance of the pore sizes suggested in JP '431, which are disclosed in the context of a non-homogenous layering of melted sulfur and graphite cloth, would be understood by one of ordinary skill in the art. As such, even arguing that both Chu and JP '431 share a common field of endeavor, the mere existence of features in a related field does not provide evidence of a motivation to make a combination in the exact claimed form. Thus, without a suggestion, there remains insufficient evidence of a motivation to generate or alter pore sizes using the cloth of JP '431 in the context of the positive electrode suggested in Chu as is required to maintain a prima facie obviousness rejection of the claims.

On pages 9-10 and 16-17 of the Office Action, the Examiner asserts that the broad range of pores sizes disclosed in JP '431 overlaps the recited range of claim 1 establishes a prima facie obviousness rejection without requiring evidence of a motivation to use the claimed sub-range. To the extent the broad range disclosed in JP '431 overlaps the range recited in claim 1, it is noted that the mere fact that a broad range encompasses a narrower range does not always substantiate a prima facie obviousness rejection. MPEP 2144.05(I) specifically warns that "[i]f

the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus." See, *In re Peterson*, 65 USPQ2d 1379, 1382-83, n. 1 (Fed. Cir. 2003) cited in MPEP 2144.05(I). As such, as opposed to cases where narrower ranges are disclosed in the prior art and encompass a claimed subrange, where very broad ranges are disclosed which encompass a claimed subrange, there needs to be evidence as to why one skilled in the art would choose the claimed subrange within this much larger range. *Id.* citing *In re Baird*, 29 USPQ2d 1550 (Fed. Cir. 1994) (prima facie obviousness not shown where generic formula encompassing 100 million diphenols does not anticipate claimed bisphenol A, which is within the generic formula).

In applying JP '431, the Examiner asserts that one skilled in the art would be motivated to choose the recited range as set forth in claim 1 in view of the disclosure of size ranges between 10 μm and 1000 μm . However, it is noted that the broad range disclosed in JP '431 encompasses multiple orders of magnitude and thus is analogous to a genus disclosure. There is no suggestion that one skilled in the art should investigate only sizes between 10 μm and 15 μm at the extreme low end of this range and which comprise only 0.5% of the disclosed range in JP '431.

Instead, JP '431 suggests larger sizes since the disclosed the conductor is concerned with inhibiting the movement of the conductor sulfur or sodium sulfide, which is disclosed in page 3, lines 12-19 of the Laid-Open publication. Furthermore, Examples 1 to 3 and 5 to 6 of JP '431 suggest pore sizes of graphite of 20 to 350 μm range and which show a desirable discharge capacity. In contrast, Example 7 of JP '431 discloses a pore size of graphite of 8 μm having a poor discharge capacity. As such, JP '431 teaches away from lower ranges (i.e., ranges below 20 μm) such that one skilled in the art would not have a motivation to investigate such lower ranges since the expected result would be poor.

As such, to the extent that the broad range of JP '431 encompasses a portion of the size range recited in claim 1, there remains insufficient evidence of record as to why one skilled in the art would utilize the specific recited range of claim 1. Without such evidence, there remains insufficient evidence to maintain a prima facie obviousness rejection of claim 1 in view of Chu and JP '431.

Additionally, in making a rejection based on the obviousness of a claimed feature, the Examiner needs to account for evidence in embodiments and experiments set forth in the specification that show the non-obvious nature of the feature. *In Re Glaug*, 62 USPQ2d 1151 (Fed. Cir. 2002). As noted in MPEP 2144.08, "a showing of unexpected results for a single

member of a claimed subgenus, or a narrow portion of a claimed range would be sufficient to rebut a *prima facie* case of obviousness if a skilled artisan 'could ascertain a trend in the exemplified data that would allow him to reasonably extend the probative value thereof.' *In re Clemens*, 622 F.2d 1029, 1036, 206 USPQ 289, 296 (CCPA 1980) (Evidence of the unobviousness of a broad range can be proven by a narrower range when one skilled in the art could ascertain a trend that would allow him to reasonably extend the probative value thereof.)" Thus, to rebut a *prima facie* obviousness rejection using unexpected results, the applicants need not show unexpected or improved properties over the entire claimed range so long as the unexpected benefits are shown by a trend as would be understood by one skilled in the art. MPEP 2144.08(II)(B).

On pages 13-14 of the Office Action, the Examiner asserts that any comparison must be between the claimed invention and the closest available prior art. As a point of clarification, the examples set forth in the specification, Tables, and FIGs. demonstrate a difference in performance relevant to pore sizes of between 15 μm and 5 μm pore diameters as compared to 30 μm . As similarly noted by the Examiner on page 5 of the Office Action, as the pore diameter decreases to within 15 μm and 5 μm , performance improves in regard to at least long term capacity retention and discharge current density retention and dramatically improves the performance over pore diameters in excess of 30 μm . Moreover, it is respectfully submitted that this unexpected trend demonstrates the non-obvious nature of the claimed invention as compared to the combination, which neither disclosed nor suggested such an outcome. Thus, even assuming *arguendo* that the Examiner is correct in asserting on page 17 of the Office Action that JP '431 teaches the criticality of having pores to impart conductivity, there is no suggestion in JP '431 that the claimed subrange set forth in claim 1 would have improved conductivity properties as compared to any of the other 985 different pore sizes disclosed in JP '431.

Moreover, while the Examiner requires that the comparison be between the claimed invention and the closest prior art in order to establish unexpected properties, in applying the combination against the instant application, the Examiner is asserting that the combination of Chu and JP '431 represents the closest available prior art. Specifically, the Examiner asserts that the combination discloses the features of the invention (including the range and materials). Since the difference between Comparative Example 1 and Examples 1 and 6 is the size of the pores, the existing evidence in the specification presents objective evidence as to the significance of the pore size which is neither suggested nor disclosed in the prior art. Since the Examiner has not addressed this evidence of non-obviousness contained in the specification as

compared to any expected results in regards to whether such evidence rebuts any prima facie obviousness rejection, it is respectfully submitted that such evidence supports the non-obvious nature of the size range recited in claim 1. It is requested that the Examiner reconsider and withdraw the rejection of claim 1.

Similarly, while the Examiner asserts on pages 18 that pore size recited in claim 3, while outside of the disclosed range, is "close enough" to suggest obviousness, there remains no disclosure or suggestion as to why one of ordinary skill in the art would explore such an additional size as compared to ranges in excess of 1000 μm . In essence, no such expectation of improved results was set forth in JP '431 for pore diameters less than 10 μm , and no suggestion is provided that such a benefit exists so as to a specific subrange or pore size at the extreme low end of the 10 μm or above 1000 μm is disclosed in JP '431. Further, it is respectfully submitted that, as shown in Table 1, it is respectfully submitted that the evidence is sufficient to demonstrate the trend further emphasizing that ranges below 10 μm and at or above 5 μm present results not suggested in or expected from JP '431.

As noted above and in MPEP 2144.08, applicants are not required to provide evidence to each portion of a range so long as one skilled in the art would detect a trend for the unexpected results. Consistent with the Examiner's statement on page 19 of the Office Action, at least Example 1 demonstrates that pore sizes of 5 μm imparts a novel feature which presents a patentable distinction over the combination. It is therefore respectfully submitted that there is no evidence of a suggestion to reach beyond one specific portion of the disclosed range in JP '431 as is required to maintain a prima facie obviousness rejection of claim 3, and similarly for claim 2. Moreover, it is respectfully requested that, to the extent that the combination is "close enough" to maintain a prima facie obviousness rejection, there is evidence of record evidencing the non-obvious nature of the ranges recited in claim 2 and the size recited in claim 3 which rebuts such a prima facie case.

On pages 9-10 and 16-17 of the Office Action, the Examiner asserts that the broad range of pores sizes disclosed in JP '431 overlaps the recited range of claim 1 establishes a prima facie obviousness rejection without requiring evidence of a motivation to use the claimed sub-range. To the extent the broad range disclosed in JP '431 overlaps the range recited in claim 1, it is noted that the mere fact that a broad range encompasses a narrower range does not always substantiate a prima facie obviousness rejection. MPEP 2144.05(I) specifically warns that "[i]f the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus." See, *In re Peterson*, 65 USPQ2d 1379, 1382-83,

n. 1 (Fed. Cir. 2003) *cited in* MPEP 2144.05(I). As such, as opposed to cases where narrower ranges are disclosed in the prior art and encompass a claimed subrange, where very broad ranges are disclosed which encompass a claimed subrange, there needs to be evidence as to why one skilled in the art would choose the claimed subrange within this much larger range. *Id. citing In re Baird*, 29 USPQ2d 1550 (Fed. Cir. 1994) (prima facie obviousness not shown where generic formula encompassing 100 million diphenols does not anticipate claimed bisphenol A, which is within the generic formula).

In applying JP '431, the Examiner asserts that one skilled in the art would be motivated to choose the recited range as set forth in claim 1 in view of the disclosure of size ranges between 10 μm and 1000 μm . However, it is noted that the broad range disclosed in JP '431 encompasses multiple orders of magnitude and thus is analogous to a genus disclosure. There is no suggestion that one skilled in the art should investigate only sizes between 10 μm and 15 μm at the extreme low end of this range and which comprise only 0.5% of the disclosed range in JP '431. Instead, JP '431 suggests larger sizes in the Examples 1 to 3 and 5 to 6 of JP '431 and teaches away from lower pore sizes in at least Example 7 of JP '431. As such, JP '431 teaches away from lower ranges (i.e., ranges below 20 μm).

As such, to the extent that the broad range of JP '431 encompasses a portion of the size range recited in claim 1, there remains insufficient evidence of record as to why one skilled in the art would utilize the specific recited range of claim 1. Without such evidence, there remains insufficient evidence to maintain a prima facie obviousness rejection of claim 1 in view of Chu and JP '431.

Additionally, in making a rejection based on the obviousness of a claimed feature, the Examiner needs to account for evidence in embodiments and experiments set forth in the specification that show the non-obvious nature of the feature. *In Re Glaug*, 62 USPQ2d 1151 (Fed. Cir. 2002). As noted in MPEP 2144.08, "a showing of unexpected results for a single member of a claimed subgenus, or a narrow portion of a claimed range would be sufficient to rebut a *prima facie* case of obviousness if a skilled artisan 'could ascertain a trend in the exemplified data that would allow him to reasonably extend the probative value thereof.' *In re Clemens*, 622 F.2d 1029, 1036, 206 USPQ 289, 296 (CCPA 1980) (Evidence of the unobviousness of a broad range can be proven by a narrower range when one skilled in the art could ascertain a trend that would allow him to reasonably extend the probative value thereof.)" Thus, to rebut a prima facie obviousness rejection using unexpected results, the applicants need not show unexpected or improved properties over the entire claimed range so long as the unexpected benefits are shown by a trend as would be understood by one skilled in the art.

MPEP 2144.08(II)(B).

On pages 13-14 of the Office Action, the Examiner asserts that any comparison must be between the claimed invention and the closest available prior art. As a point of clarification, the examples set forth in the specification, Tables, and FIGs. demonstrate a difference in performance relevant to pore sizes of between 15 μm and 5 μm pore diameters as compared to 30 μm . As similarly noted by the Examiner on page 5 of the Office Action, as the pore diameter decreases to within 15 μm and 5 μm , performance improves in regard to at least long term capacity retention and discharge current density retention and dramatically improves the performance over pore diameters in excess of 30 μm . This result is contrary to the performance *degradation* as the pore sizes decrease as predicted by the Examples of JP '431. Thus, it is respectfully submitted that the unexpected trend set forth by the example of the instant application demonstrates the non-obvious nature of the claimed invention as compared to the combination, which neither disclosed nor suggested such an outcome. Thus, even assuming *arguendo* that the Examiner is correct in asserting on page 17 of the Office Action that JP '431 teaches the criticality of having pores to impart conductivity, there is no suggestion in JP '431 that the claimed subrange set forth in claim 1 would have improved conductivity properties as compared to any of the other 985 different pore sizes disclosed in JP '431.

Moreover, while the Examiner requires that the comparison be between the claimed invention and the closest prior art in order to establish unexpected properties, in applying the combination against the instant application, the Examiner is asserting that the combination of Chu and JP '431 represents the closest available prior art. Specifically, the Examiner asserts that the combination discloses the features of the invention (including the range and materials).

Since the difference between Comparative Example 1 and Examples 1 and 6 is the size of the pores, the existing evidence in the specification presents objective evidence as to the significance of the pore size which is neither suggested nor disclosed in the prior art. Since the Examiner has not addressed this evidence of non-obviousness contained in the specification as compared to any expected results in regards to whether such evidence rebuts any *prima facie* obviousness rejection, it is respectfully submitted that such evidence supports the non-obvious nature of the size range recited in claim 1. It is requested that the Examiner reconsider and withdraw the rejection of claim 1.

Similarly, while the Examiner asserts on pages 18 that pore size recited in claim 3, while outside of the disclosed range, is "close enough" to suggest obviousness, there remains no disclosure or suggestion as to why one of ordinary skill in the art would explore such an additional size as compared to ranges in excess of 1000 μm . In essence, no such expectation

of improved results was set forth in JP '431 for pore diameters less than 10 μm , and no suggestion is provided that such a benefit exists so as to a specific subrange or pore size at the extreme low end of the 10 μm or above 1000 μm is disclosed in JP '431. Further, it is respectfully submitted that, as shown in Table 1, it is respectfully submitted that the evidence is sufficient to demonstrate the trend further emphasizing that ranges below 10 μm and at or above 5 μm present results not suggested in or expected from JP '431.

As noted above and in MPEP 2144.08, applicants are not required to provide evidence to each portion of a range so long as one skilled in the art would detect a trend for the unexpected results. Consistent with the Examiner's statement on page 19 of the Office Action, at least Example 1 demonstrates that pore sizes of 5 μm imparts a novel feature which presents a patentable distinction over the combination. It is therefore respectfully submitted that there is no evidence of a suggestion to reach beyond one specific portion of the disclosed range in JP '431 as is required to maintain a *prima facie* obviousness rejection of claim 3, and similarly for claim 2. Moreover, it is respectfully requested that, to the extent that the combination is "close enough" to maintain a *prima facie* obviousness rejection, there is evidence of record evidencing the non-obvious nature of the ranges recited in claim 2 and the size recited in claim 3 which rebuts such a *prima facie* case.

Lastly and as noted previously in the Response entered October 4, 2005, since JP '431 teaches using melted sulfur in order to allow the sulfur to infuse a graphite felt or cloth having the porosity disclosed in JP '431, the type of slurry suggested in Chu would not be understood as being capable of infusing the pores suggested in JP '431. Since the material of the slurry of Chu is a point of novelty of Chu according to col. 4, lines 27-49 and col. 5, lines 1-43, alteration of the material to accommodate the graphite cloth of Chu would change the mode of operation of Chu, especially since JP '431 relates to a type of battery using liquid instead of solid electrolytes in the context of a sodium-sulfur battery.

As noted in MPEP 2143.01, "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)." Thus, even assuming that the combination would not be catastrophic or deleterious to the resulting combination, references cannot be combined where the proposed combination would so change a basic mode of operation of the primary reference. As such, as the use of the positive active material of Chu would appear to change a mode of operation of the cloth in JP '431 since the positive active material would not infuse the pores and a point of novelty of Chu is the chosen positive active material, it is

respectfully submitted that there is insufficient evidence to maintain a prima facie obviousness rejection of claims 1-4, 8-17, 38, and 39 under 35 U.S.C. §103 in view of the Chu and JP '431.

Claims 4, 8-17, 38 and 39 are deemed patentable due at least to their depending from claim 1.

B. Rejection of claims 5-7 in view of Chu, JP '431, and Kovalev et al.

In the Office Action at pages 10-11, the Examiner rejects claims 5-7 under 35 U.S.C. §103 in view of Chu, JP '431, and Kovalev et al. (U.S. Patent No. 6,652,440). The rejection is respectfully traversed and reconsideration is requested.

The Examiner relies upon Kovalev et al. as disclosing a particle size of elemental sulfur in the range of 0.01 to 100 microns, but not as otherwise curing the above noted defect of the combinations of Chu et al. and JP '431 as applied to claim 4, from which claims 5-7, depend. As such, it is respectfully submitted that the combination does not disclose the invention recited in claims 5-7 due at least to the combinations not disclosing the features of claim 4.

Additionally, Kovalev et al. suggests multiple particle sizes for elemental sulfur, including particles from .01 to 100 microns, but Kovalev et al. does not suggest which particle size should be used within this broad range, or which portion of the range is advantageous to use. Importantly, Kovalev et al. does not suggest why the disclosed elemental sulfur is advantageous over other elemental sulfurs, such as that disclosed in Chu et al.

On page 18 of the Office Action, the Examiner asserts that the disclosed range in Kovalev et al. overlaps the range recited in claims 5-7 such that the Examiner has met a prima facie obviousness burden. However, as similarly noted above, the examples in the instant application set forth evidence of the advantages of specific ranges of particle sizes which are not suggested in Chu et al., JP '431, or in the broad range suggested in Kovalev et al. Indeed, the range suggested in Kovalev et al. is even larger than that suggested in JP '431 and thus also requires evidence of a motivation to choose the recited range as set forth in claims 5-7 (which represent at most 0.2% of the entire disclosed range) to maintain a prima facie obviousness rejection.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, that all pending claims patentably distinguish over the prior art. Thus, there being no further

outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

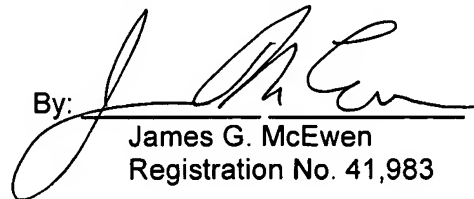
If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited and possibly concluded by the Examiner contacting the undersigned attorney for a telephone interview to discuss any such remaining issues.

If there are any additional fees associated with the filing of this Amendment, please charge the same to our Deposit Account No. 503333.

Respectfully submitted,

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